
Space Weather Technical Forecast

Issued on Sunday 10 November 2024 at 01:21 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Moderate solar activity is likely, with a slight chance of X-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Moderate during the period, with AR3889 producing an impulsive M1.3 flare at 09/2050 UTC.

There are currently seven sunspot regions on the visible disc, with the southern portion of AR3886 now re-numbered as AR3890. There are two large and complex regions present. AR3889, in the southeast, contains a number of mature spots and including a significant delta configuration in its trailing region. AR3883, in the southwest, has mature leading and trailing spots, but has seen some decay in the spots occupying the intermediate region and the small delta spot signal is becoming increasingly tenuous. AR3886 approaching centre-disc, is a sparsely populated spot that consists of a number of small spots and pores and clusters of weaker spots extending across a large longitudinal and latitudinal area, with the newly numbered AR3890 to its south. AR3879 continues as a large single mature spot in the northwest. The remaining spot regions are smaller and magnetically simple.

No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Solar winds at L1 measured by ACE and DSCOVR were indicative of ongoing magnetic cloud and perhaps CH HSS influences. Wind speeds varied between slightly elevated and background, around 360-450 km/s. Density has been highly variable, often above average, with a likely peak of around 28 ppcc measured at 09/0800 UTC. The Interplanetary Magnetic Field (IMF), Bt, was generally Moderate, between 5-16nT, with peak values seen early in the period. The north-south component, Bz, was mostly southward (negative) directed to start the period, at Weak to Moderate levels with a minimum around -13nT. Values became more variable and moderately positive towards the end of the period, with a max of +10nT. Phi angle was generally neutral, neither persistently negative (toward the Sun), or positive (away from the Sun). Resultant Geomagnetic Activity was generally Unsettled to Active (Kp 3-4), with two G1 Minor Storm (Kp 5) intervals 0900-1500UTC.

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was at

background levels throughout. The associated 24-hour fluence was well below the Active threshold, with 1.19e6 integrated flux observed at 10/0000UTC.

Four-Day Space Weather Forecast Summary

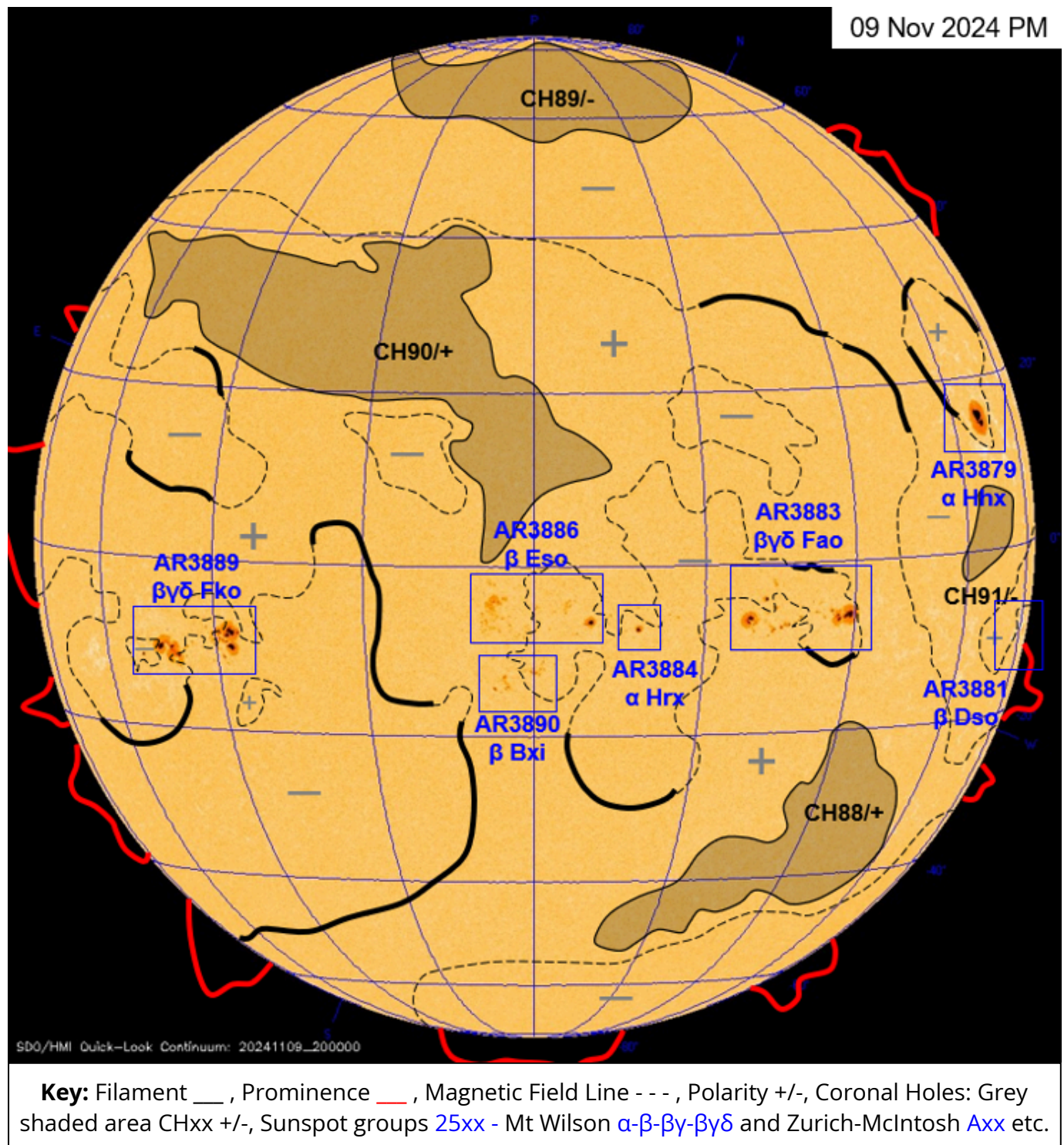
Solar Activity: Low to Moderate activity is forecast, with a likelihood of isolated M-class flares and a slight chance of X-class flares, most probably from AR3889.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are currently forecast. Solar winds are currently experiencing ongoing CME and perhaps coronal hole high speed stream influences. Slightly Elevated solar wind speeds are considered most likely, around 400-450 km/s slowly easing on Day 1 (10 Nov). Further HSS connection may occur Day 1 (10 Nov) until Day 2 (11 Nov), perhaps bringing Slightly Elevated to briefly Elevated speeds but this low confidence. Solar wind speeds expected to trend generally back towards background levels during Day 2 and 3 (11-12 Nov) in the absence of further enhancement. An increase in solar winds then likely into Day 4 (13 Nov) with an expected connection to some portion of the large coronal hole currently crossing centre-disk. This likely bringing Slightly Elevated to Elevated speeds to end the period.

Generally Quiet to Unsettled (Kp2-3) activity is forecast but with Active (Kp4) intervals likely and a slight chance of peak G1/Minor Storm conditions, between Days 1-3 (10-12 Nov) due to the risk of minor CME and HSS influence. Unsettled to Active (Kp3-4) condition increasingly likely to end the period, with the chance of G1/Minor Storm conditions rising slightly.

Energetic Particles / Solar Radiation: High energy proton flux at GOES-18 is at normal background levels. There is a rising slight chance of S1/Minor Proton Storms should we see any significant flares, as the larger regions on the disk rotate into more geoeffective positions in the western hemisphere. The high energy electron flux is expected to remain at generally Background to Moderate levels. The associated fluence is expected to persist below Active levels.

Figure 1: Solar Synoptic Map Valid 09/2000 UTC.



Geomagnetic Storms

No Earth-directed CMEs are currently forecast, however, some faint ejecta, mainly associated with occasional flare activity from AR3883 near centre-disc over the past couple of days, cannot completely be discounted as having some Earth directed trajectory later in the period. Any potential impacts, however, would be expected to be weak. Additionally, a number of long and large filaments on the facing-disc could disrupt and act as a source for Earth-directed CMEs in the coming days.

Solar winds are currently experiencing ongoing CME and perhaps coronal hole high speed stream influences. Slightly Elevated solar wind speeds are considered most likely, around 400-450 km/s slowly easing on Day 1 (10 Nov). MOSWOC's ENLIL model shows an ongoing significant enhancement from CH88/+ HSS influence with Strong solar wind speeds. This is considered erroneous with the coronal hole positioned south on the disc with only a limited potential connection expected. If a connection were to occur then this may happen Day 1 (10 Nov) until Day 2 (11 Nov), perhaps bringing Slightly Elevated to briefly Elevated solar wind speeds. Solar wind speeds expected to trend back towards background levels during Day 2 and 3 (11-12 Nov) in the absence of further enhancement. An increase in solar winds then likely into Day 4 (13 Nov) with an expected connection to some portion of the large coronal hole CH90/+ currently crossing centre-disc. This likely bringing Slightly Elevated to Elevated solar wind speeds to end the period.

Generally Quiet to Unsettled (Kp2-3) activity is forecast but with Active (Kp4) intervals likely and a slight chance of peak G1/Minor Storm conditions, between Days 1-3 (10-12 Nov) due to the risk of minor CME and HSS influence. Unsettled to Active (Kp3-4) condition increasingly likely to end the period, with the chance of G1/Minor Storm conditions rising slightly.

Geomagnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	Yes	20	15	10	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

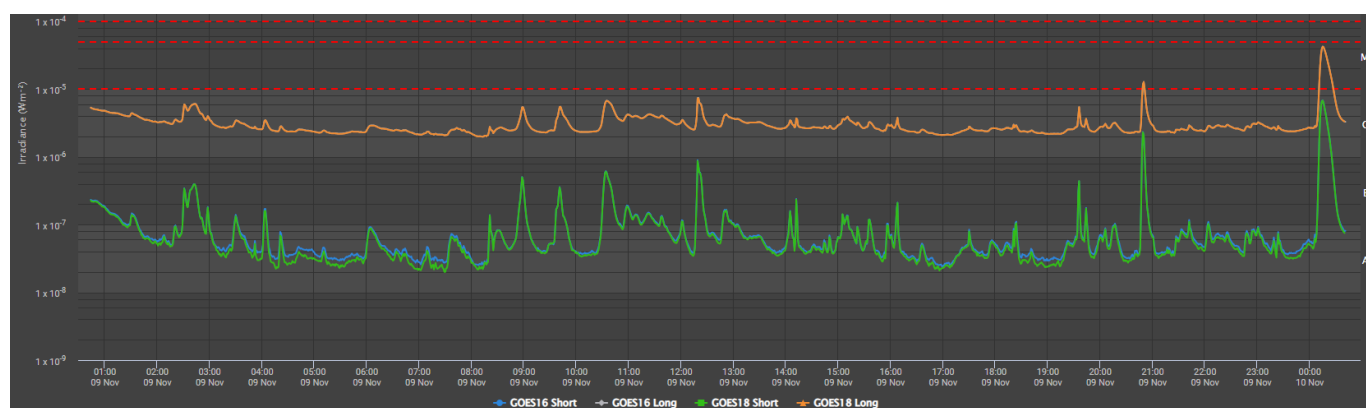
Radio Blackouts - X-Ray Flares

There are currently seven sunspot regions on the visible disc. Two elongated and magnetically complex regions, AR3889 in the southeast, and AR3883 in the southwest, provided the bulk of the current flare risk. AR3889 appears the most active region, with a number of mature spots a significant delta configuration in its trailing region. AR3886, in the southeast, approaching centre-disc is also contributing frequent low level flare activity; a sparsely populated region that consists of a large number of small spots and pores extending across a large longitudinal and latitudinal area, with the newly numbered AR3890 to it's south.

Low to Moderate activity is forecast, with a likelihood of isolated M-class flares and a slight chance of a X-class flare, most probably from AR3889. All main flare producing regions are expected to remain on the visible disk throughout the period, and with far-side sounding data and recurrence not suggesting any significant returning regions the flare risk is kept steady through the period pending further developments.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	60	60	60	60
Very Active	R3-R5 (X Class)	No	10	10	10	10

Figure 2: Latest 24hr GOES16/18 X-Ray Flux trace.



Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES-18 is at normal background levels. There is a rising slight chance of S1/Minor Proton Storms or greater however should we see any significant flares, with the larger regions on the disk rotating into more geoeffective positions in the western hemisphere through the period.

Radiation Storms	Level ($\text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	No	10	10	15	20
Very Active	$\geq \text{S3}^*$	No	1	1	1	1
* $\text{S3} \geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and/or $50 \text{ MeV} \geq 10 \text{ pfu}$. ($\text{pfu} = \text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}$)						

High Energy Electrons ($\geq 2\text{MeV}$)

High energy electron flux (greater than 2MeV) as observed by GOES16 is at Background levels.

The high energy electron flux is expected to remain at generally Background to Moderate levels, potentially increasing to brief High levels at diurnal peak early in the period. The associated 24 hour fluence is expected to persist below Active levels, which corresponds with the guidance shown in MOSWOC REFM output. Therefore the REFM model is considered to be showing reasonable guidance.

GEO Electron Environment	Level ($\text{cm}^{-2}\text{sr}^{-1}\text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2\text{ MeV}$ $\geq 1\times10^8$	No	1	1	5	1
Very Active	$\geq 2\text{ MeV}$ $\geq 1\times10^9$	No	1	1	1	1

Figure 3: Latest MOSWOC REFM model output.

